

Dilute Betadine Lavage Before Closure for the Prevention of Acute Postoperative Deep Periprosthetic Joint Infection

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Abstract: This study evaluated the efficacy of a dilute Betadine (Purdue Pharma, Stamford, Conn) lavage in preventing early deep postoperative infection after total hip (THA) and knee (TKA) arthroplasty. A protocol of dilute Betadine lavage (0.35%) for 3 minutes was introduced to the practice of the senior author in June 2008. A total of 1862 consecutive cases (630 THA and 1232 TKA) performed before this were compared with 688 consecutive cases (274 THA and 414 TKA) after for the occurrence of periprosthetic infections within the first 90 days postoperatively. Eighteen early postoperative infections were identified before the use of dilute Betadine lavage, and 1 since (0.97% and 0.15%, respectively; $P = .04$). There were no significant demographic differences between the 2 groups. Betadine lavage before wound closure may be an inexpensive, effective means of reducing acute postoperative infection after total joint arthroplasty. **Keywords:** betadine lavage, TKA, THA, periprosthetic joint infection.
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Deep periprosthetic joint infection is a rare but devastating complication associated with extensive economic, physical, and psychologic costs. Aseptic technique, careful skin preparation, and prophylactic antibiotics all play a role in decreasing postoperative infection. Despite these measures, deep infections still occur with a prevalence ranging from 0.3% to 1.9% in series ranging in size from 819 to 43 149 subjects.¹⁻⁵ Although measures are in place to decrease infection incidence, the projected increased volume of arthroplasty surgery⁶ ensures that this complication will be encountered with greater frequency in the future.

Prior studies have demonstrated that a dilute Betadine lavage of the surgical wound before closure can decrease the rate of postoperative infection in orthopedic, urologic, cardiovascular, and general surgery.^{7,8} Betadine contains povidone-iodine, a stable chemical complex of polyvinylpyrrolidone and elemental iodine that

gradually releases free iodine, which is toxic to microorganisms.⁹ This antiseptic has been shown to have broad spectrum bactericidal activity with minimal toxicity or side effects to the human body.¹⁰⁻¹⁷ The purpose of our study was to determine the effectiveness of a dilute Betadine lavage before wound closure to prevent deep periprosthetic joint infection after primary total hip (THA) and total knee (TKA) arthroplasty.

Methods

A total of 904 consecutive primary THA and 1646 consecutive primary TKA were performed by a single surgeon (CDV) between February 2002 and March 2010. These cases were retrospectively reviewed for the presence of deep postoperative infection that presented within 90 days after surgery. Infection was defined as a minimum of 2 cultures from the joint showing bacterial growth on solid media or as meeting 2 of the 3 following criteria: at least 1 culture positive for growth on solid media, gross purulence encountered within the joint at the time of surgical exploration, and final histopathologic tissue examination showing an average of more than 10 polymorphonuclear cells in the 5 most cellular fields.¹⁸

The use of a dilute Betadine lavage before wound closure was introduced to the senior author's practice in June 2008. The Betadine is obtained from a sterile, single-dose prepack (Povidone-Iodine Paint Sponge Sticks, Aplicare, Inc, Meriden, Conn) that is part of the

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hip and knee arthroplasty preparation kit opened at the beginning of each case at our institution. The cost of 1 packet of Betadine is \$1.11. To create the dilute solution, the scrub nurse draws up 17.5 mL of 10% povidone-iodine with a syringe and mixes it with 500 mL of sterile isotonic sodium chloride solution. This results in a dilution of 0.35% povidone-iodine for use before wound closure. After implantation of the prosthetic components, the wound is soaked with 500 mL of the dilute Betadine solution for 3 minutes, followed by pulsatile lavage with 1 L of isotonic sodium chloride solution without antibiotics. Before final closure, Betadine is applied to the skin surrounding the incision. Before initiating this protocol, wounds were lavaged with 1 L of isotonic sodium chloride solution only.

Patients in both groups were given perioperative antibiotic prophylaxis, which consisted of cefazolin given within 1 hour of the skin incision, and clindamycin or vancomycin in patients with an allergy to penicillin. Antibiotics were discontinued after 24 hours in all cases. Skin preparation included shaving with electric clippers and then painting with Duraprep (3M Healthcare, St. Paul, Minn). Antibiotic-loaded cement was used selectively in patients felt to be at higher risk for infection including those with diabetes mellitus, inflammatory arthropathy, morbid obesity (body mass index >40 kg/m²), skin disorders such as psoriasis, or other immunocompromising disorders.

A total of 1862 cases (630 THA and 1232 TKA) were performed before the initiation of the Betadine lavage protocol, and 688 cases (274 THA and 414 TKA) were performed after. Subjects allergic to iodine were not treated with Betadine and therefore were excluded from the study. Data were analyzed using Student *t* test for continuous variables (age) and χ^2 for categorical variables (sex, primary diagnosis). χ^2 analysis was used to compare rates of infection with and without the use of Betadine lavage. A power analysis was performed, which demonstrated that a minimum of 480 patients in each group would be needed to detect a 50% reduction in the infection rate from 1.0% to 0.5% with an α value of .05 and power of 0.80.

Results

Acute postoperative deep infection was diagnosed in 18 of 1862 total joint arthroplasties before the use of dilute Betadine lavage and in 1 of 688 total joint arthroplasties after the initiation of this protocol (0.97% compared with 0.15%; $P = .04$; Table 1). There were no significant

Table 1. Comparison of Infection Rates

	Total	Infected	%	<i>P</i>
Pre-Betadine	1852	18	0.97%	.018
Post-Betadine	688	1	0.15%	

Table 2. Summary of Demographic Data

		Pre-Betadine	Post-Betadine	<i>P</i>
Age		63.7 y	63.4 y	.59
Sex	Male	33.8%	33.1%	.74
	Female	66.2%	66.9%	
Primary diagnosis	Osteoarthritis	88.8%	90.6%	.58
	Rheumatoid arthritis	2.8%	2.0%	
	Avascular necrosis	3.1%	2.7%	
	Other	5.4%	4.7%	

differences noted between the 2 groups with regard to mean patient age, sex ratio, or primary diagnosis between the 2 groups (Table 2). Seven hips (2.6%) were a hybrid construct with a cemented femoral component and a cementless acetabular component before the use of Betadine compared with 26 (4.1%) after ($P = .34$). There was, however, a significant difference in the use of a hybrid knee construct (cementless femoral component and a cemented tibial component) before (136/1232; 11.0%) as opposed to after (0%) the use of the Betadine lavage ($P < .001$).

The 9 hip infections in the pre-Betadine group occurred at an average of 26 days (14-54 days) after the index procedure; the infecting organism was *Staphylococcus aureus* in 6 cases (1 methicillin sensitive and 5 resistant), and 1 each of group B *Streptococcus*, *Enterococcus*, and *Proteus mirabilis*. The 9 knee infections in the pre-Betadine group occurred an average of 28 days (range, 12-74 days) after the index procedure with the infecting organisms of 5 *S aureus* (3 methicillin sensitive and 2 methicillin resistant) and 2 coagulase-negative *Staphylococcus*, and 2 patients had no growth on cultures but met the study criteria for infection as outlined above. The single infection in the post-Betadine group occurred 13 days after the primary procedure, and the infecting organism was methicillin-sensitive *S aureus*.

Discussion

Our results demonstrate that a 3-minute dilute Betadine lavage combined with painting of the skin with 10% Betadine before surgical closure was associated with a significant reduction in the infection rate after primary TKA and THA (0.97%-0.15%, $P = .04$). Although this technique has not previously been described in total joint arthroplasty, it has been studied in other surgical fields. A recent meta-analysis reviewed 15 studies with level I or II evidence evaluating the prophylactic utility of Betadine irrigation in general, cardiovascular, orthopedic spine, and urologic surgery. Povidone-iodine concentrations in these studies ranged from 0.35% to 10%. Ten of these studies found Betadine to be effective compared with the use of saline, water, or no irrigation, whereas the other 5 found no difference. There were no complications associated with the

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